

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-286936

(43)Date of publication of application : 04.11.1997

(51)Int.Cl.

C09D 5/24
B05D 1/36
C09D 1/00
C09D183/04
H01B 1/22
H01B 13/00

(21)Application number : 08-100080

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(22)Date of filing : 22.04.1996

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(54) APPLYING SOLUTION FOR FORMING TRANSPARENT CONDUCTIVE FILM,
TRANSPARENT CONDUCTIVE FILM USING THE SAME AND ITS FORMATION

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain an applying solution for forming transparent conductive film which possesses a function suppressing surface reflection on a CRT picture and a function reducing transmittance without scattering visible light and can produce a suitable film to shield low-frequency electric field due to the conductivity superior to that in the past, conveniently in a low cost by using an applying method and to provide a transparent conductive film using the same and its formation.

SOLUTION: This applying solution for forming transparent conductive film contains silver in addition to one or more than two kinds of compounds selected from a group consisting of palladium, copper and gold and comprises a solution dispersing conductive fine grains with a grain size of less than 50nm into a polar solvent or, in addition, a solution dispersing conductive fine grains, which contain one or more than two kinds of compounds selected from a group consisting of tin-added indium oxide, antimony-added tin oxide and aluminum-added zinc oxide, into polar solvent. A transparent conductive film formed by using this solution is produced by coating this applying solution on a base material, additionally coating a solution of an alkylsilicate partial hydrolysis polymer on it and then firing it.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the coating liquid for transparence electric-conduction film formation which makes a polar solvent come to distribute the conductive particle which has the conductivity which was excellent in the glass front of cathode-ray tubes, such as a display of OA equipment, and the Braun tube of television, conventionally in more detail about the coating liquid for transparence electric-conduction film formation, the transparence electric-conduction film using this, and its formation approach for giving an electric-field shielding effect, and contains the silver for the suitable film formation for electric shielding of low-frequency electric field.

[0002]

[Description of the Prior Art] The environment where many OA equipment was introduced into office by automation in recent years, faced the display of OA equipment, and it worked all day became less new. When working in contact with this, it is required for the cathode-ray tube (CRT) of a computer that the display screen does not impress visual fatigue legible and that there are no adhesion of dust and electric shock shock by electrification of the front face. In addition to these, recently, we are anxious about the adverse effect to the body of a low frequency electromagnetic wave generated from CRT, and CRT which such an electromagnetic wave does not reveal outside is desired.

[0003] It generates from a deflecting coil or a flyback transformer, and an electromagnetic wave is in the inclination for a still bigger electromagnetic wave to tend to leak to a perimeter with enlargement of TV. Leakage of a field can prevent most with the device of changing the configuration of a deflecting coil.

[0004] On the other hand, to leakage of electric field, it can prevent by forming conductive tapetum lucidum in a CRT glass front front face. This approach is the same on the cure and principle target which have been conventionally taken for electrification prevention. however, the conductivity of the conductive film in this case -- antistatic -- a value far higher than the conductivity of the conductive film currently formed in business is calculated. Although [electrification prevention / surface electrical resistance / with 108ohms / ** extent] it is enough, it is necessary to form the tapetum lucidum of low resistance of 102-103ohms / ** base in prevention of leakage electric field preferably below at least 106ohms / **.

[0005] Since it corresponds to the above-mentioned demand, some proposals are made from before. As one of them, there is the approach of forming the coat of conductive oxides, such as tin oxide and indium oxide, in the glass front front face of CRT by vacuum deposition, CVD, a spatter, etc. Since the film formed using this approach consists of single presentations of tin oxide or indium oxide, the conductivity of a raw material appears as it is, and sufficient low resistance for an electric-field shielding effect is acquired. Moreover, it is easy to carry out processing of acid resisting, without being able to control thickness to homogeneity thinly enough and spoiling the resolution of CRT.

[0006] However, an ambient atmosphere must be controlled and processed for every CRT, great cost starts coat formation, and it is very inconvenient to manufacture of practical CRT. Therefore, if CRT of a special application was removed, it was thought that these approaches were unsuitable, and the film

formation approach which it can be cheaper and can be performed promptly was desired.

[0007] The processing liquid for electric-field shielding which distributed very detailed indium stannic acid ghost (ITO) powder with the binding material of alkyl silicate as what can realize low surface electrical resistance by low cost in the polar solvent which uses a N-methyl-2-pyrrolidone as a principal component is proposed (Japanese-Patent-Application-No. No. 3071105 [four to] official report).

According to thickness, the surface-electrical-resistance value of 103-105ohms / ** is acquired by calcinating this processing liquid at the temperature of 200 degrees C or less after spreading / desiccation to a CRT glass front. According to spreading of this ink, compared with other transparence electric conduction film formation approaches, such as vacuum deposition and a spatter, it is far simple, a manufacturing cost is also low, and it is a very advantageous approach as a response to electric-field shielding of CRT. However, unsatisfactory was difficult for 102-103ohms / ** base which there is a limitation which can be reduced in the surface-electrical-resistance value acquired, and is made desirable.

[0008] As for the electric conduction film in here, what must not spoil the transparency or resolution of a screen and can also control permeability to some extent is desirable. That is, although the transmission of a CRT glass front is restricted to moderate level for improvement in image contrast, since glass thickness changes with locations of a screen and an ununiformity is produced in transmission, to be able to adjust surface type membrane formation and transmission about 1 to twenty percent is desired. In this case, although a screen can be made dark of course in homogeneity, in order to drop light transmission, without dropping resolution, there is little diffusion scattered light by surface type membrane formation as much as possible, and it is desirable to drop permeability on the optical absorption by the film construction material itself.

[0009] However, with the processing liquid using above ITO, since the ITO powder which has light permeability intrinsically is used, low permeability of the dark color system which can adjust brightness is not realized.

[0010] There was a difficulty that the film which the ITO particle distributed is inadequate in film conductivity and a light permeability controllability in this way.

[0011]

[Problem(s) to be Solved by the Invention] The object of this invention has the function which controls a surface echo of a CRT screen, and it has the function to reduce permeability, without scattering about the light. And it is in simple and offering the coating liquid for transparence electric conduction film formation, the transparence electric conduction film using this, and its formation approach for producing to low cost using the applying method about the suitable film for electric shielding of the low frequency electric field which may affect the body by having the conductivity superior to conventionally.

[0012]

[Means for Solving the Problem] The coating liquid for transparence electric conduction film formation of this invention for attaining the above-mentioned technical problem It is coating liquid for transparence electric conduction film formation which made the polar solvent distribute a metal particle as a conductive particle. It is characterized by particle size being 50nm or less, including one sort chosen from the group which this metal particle becomes from palladium (Pd), copper (Cu), and gold (Au) further including silver (Ag), or two sorts or more.

[0013] Or it is characterized by being the silver system alloy particle which added one sort chosen from the group to which it is coating liquid for transparence electric conduction film formation which made the polar solvent distribute an alloy particle as a conductive particle, and this alloy particle becomes silver (Ag) from palladium (Pd), copper (Cu), and gold (Au), or two sorts or more, and particle size being 50nm or less.

[0014] Or it is further characterized by including one sort chosen from tin addition indium oxide, stibiation tin oxide, and the group that consists of an aluminum addition zinc oxide, or two sorts or more as a conductive particle at the coating liquid for transparence electric conduction film formation of one of the above.

[0015] Or it is characterized by containing an alkyl silicate partial hydrolysis polymerization object

further in the coating liquid for transparence electric conduction film formation of one of the above.

[0016] Moreover, the transparence electric conduction film of this invention for attaining the above-mentioned technical problem is characterized by being obtained by one of the above using the coating liquid for transparence electric conduction film formation of a publication.

[0017] Furthermore, the formation approach is characterized by calcinating, after carrying out the coat of the coating liquid for transparence electric conduction film formation given in one of the above to a base material and carrying out the coat of the solution of an alkyl silicate partial hydrolysis polymerization object on it further.

[0018] The transparence electric conduction film with an electric-field shielding effect can be manufactured by simple and low cost by applying and drying and calcinating the coating liquid for transparence electric conduction film formation of above-mentioned this invention in atmospheric air after that on a CRT completion ball front face or the glass front front face for CRT in front of sealing. When applying the coating liquid containing an alkyl silicate partial hydrolysis polymerization object and calcinating it after that, the burning temperature is [after applying the above-mentioned coating liquid for transparence electric conduction film formation] good at 150-450 degrees C, in order to compensate the reinforcement of the monolayer by the above-mentioned coating liquid.

[0019]

[Embodiment of the Invention] The conductive particle used for this invention uses silver (Ag) as a principal component, and contains one sort chosen from palladium (Pd), copper (Cu), and the group that consists of gold (Au), or two sorts or more. Further, other metals may cover in the shape of film on the front face of a silver particle, and other metals may cover the silver particle in the state of the particle, and mixing of one of the above is [this conductive particle may be a silver system alloy particle by which other metals were added by silver, and] sufficient as it.

[0020] At less than 0.1 % of the weight, since resistance will increase if resistance becomes instability and exceeds 30 % of the weight, the amount of metals used other than silver has 0.1 - 30 preferably good % of the weight.

[0021] The specific resistance of these conductive particles is the order of 10^{-5} - 10^{-6} ohm-cm, and has a value low double figures - triple figures compared with transparence electric conduction noble metals, such as tin addition indium oxide (ITO), stibiation tin oxide (ATO), and an aluminum addition zinc oxide (AZO). Therefore, within the film, these conductive particles form the electric conduction pass which contacted mutually, and realize still lower resistance compared with the film using an ITO particle etc.

[0022] When these conductive particles are contained 0.1% of the weight or more in coating liquid, such effectiveness of high conductivity can be expected. Although the thickness of the conductive layer formed also increases with the increment in the content of a conductive particle and surface electrical resistance falls, if 10 % of the weight is exceeded in coating liquid, while the film formation with a smooth interface will become difficult, the distributed stability of the electric conduction particle in coating liquid comes to produce the precipitate which cannot be fallen and disregarded, and is not desirable. In order to obtain the surface electrical resistance of 102-103ohms / ** base, when membranes are formed on the usual spreading conditions, about 7 or less % of the weight of a content is enough.

[0023] It is also possible to add transparent conductive oxide particles, such as ITO, ATO, and AZO, into processing liquid in addition to the above-mentioned conductive particle, and it contributes to raising permeability, although resistance of the film produced in this case goes up a little. In the thing of the demand with the low level of brightness reduction, little mixing of the above-mentioned conductive oxide particle could be carried out by making ITO, ATO, or AZO into a subject at this.

[0024] Since the particle size of a particle is too large when using the above-mentioned conductive particle, or cloudiness is produced on the formed film when condensation is strong, the resolution of a CRT screen falls and is not desirable. Although it is expressed with the value of Hayes defined by the percentage to the total amount of transmitted lights of the amount of dispersion transmitted lights, the cloudiness of a transparent membrane needs to usually stop Hayes to 5% or less, in order not to spoil the resolution of a CRT screen.

[0025] Although Hayes was proportional to thickness mostly, as a result of inquiring using the particle of various particle size, the particle size of a conductive particle was so desirable that it was small, and in order to stop Hayes to 5% or less by about 0.1-micrometer thickness, it became clear that it is important to set mean particle diameter of a conductive particle to about 50 micrometers or less. When mean particle diameter is 50 micrometers or less, as for the dispersion mode of the incidence light, most serves as the mode of the so-called Rayleigh scattering or Mie dispersion, and dispersion by the objective configuration decreases extremely. Conversely, the ** case using a particle with a mean particle diameter of 50 micrometers or more, dispersion of the particle itself and dispersion by the increment in the granularity on the front face of the film become large, and Hayes comes to exceed 5% easily.

[0026] The thickness of the film using the coating liquid of this invention has desirable about 0.05-0.6 micrometers. The reason which is 0.6 micrometers or less is for pressing down Hayes within 5%. Conversely, if it is restricted from a difficult thing, and the too thin film is produced according to the experiment, it will increase irregularity on a front face that the reason nil why 0.05 micrometers or more are desirable obtains the homogeneous membrane below this by the ink method, and it will also increase Hayes to it at the same time distribution of a conductive particle becomes island-like and resistance goes abruptly up.

[0027] The above conductive particles of microscopic small size can be altogether manufactured comparatively easily except for ITO powder. Although manufacture is generally difficult for an overly detailed thing with a mean particle diameter of 50nm or less about ITO powder, it is sold and supplied from Sumitomo Metal Mining Co., Ltd.

[0028] The coating liquid of this invention can carry out high distribution of the conductive particle with a mean particle diameter of 50 micrometers or less into the polar solvent for distribution, and can manufacture it by mixing the polar solvent for dilution to this. In a distributed-processing process, it is desirable to mix a conductive particle in the polar solvent for distribution, to carry out amalgam decomposition until floc mostly turns into a primary particle using a powerful disperser, and to acquire the mono dispersion condition of a primary particle. A ball mill, an attritor sand mill, etc. can be used as a disperser.

[0029] As a polar solvent for distribution, it has the suitable boiling point below burning temperature, and what may distribute a conductive particle efficiently is good, for example, can mention water, a N-methyl-2-pyrrolidone (NMP), ethanol, 4-hydroxy-4-methyl-2-pentanone (diacetone alcohol), isopropyl alcohol, N,N-dimethylformamide (DMF), dimethylacetamide, methyl cellosolve, an acetone, a tetra-hydroxy furan, etc. Under the present circumstances, little addition of the surfactants, such as coupling agents, such as a silane system, a titanate system, a zirconate system, and an aluminates system, a polycarboxylic acid system, a phosphoric ester system, and a silicone system, etc. may be carried out as a dispersant in order to raise dispersibility. It will be [that what is necessary is just not to be what affects conductivity in this invention] satisfactory if it is 0 - 1% of the weight of little addition.

[0030] As a polar solvent for dilution, it is the solvent for distribution and a dispersant, and compatibility, and is chosen from a solvent which has the boiling point below burning temperature. At the time of membrane formation, it is used for the purpose of raising the coating nature to a substrate, and, as for the polar solvent for dilution, this contractor can choose a suitable solvent easily with a well-known technique so that the smooth film [be / especially at the time of spreading / no nonuniformity] may be obtained.

[0031] An alkyl silicate partial hydrolysis polymerization object is for carrying out joint immobilization of the conductive particle on a glass front face, and the formal thing which alt.alkyl silicate was hydrolyzed [thing], for example and advanced dehydration condensation polymerization to some extent as such an alkyl silicate partial hydrolysis polymerization object is used. The alt.alkyl silicate which can use alt.methyl silicate (OCH₃) Si 4, alt.ethyl silicate Si (OC₂H₅) alt.propyl silicate (OC₃H₇) Si 4, alt.butyl silicate (OC₄H₉) Si 4, etc., for example, and has two or more sorts of alkyl groups in the same intramolecular as alt.alkyl silicate is sufficient. Moreover, even if it mixes and uses two or more sorts of alkyl alt.silicate, it does not interfere.

[0032] Although an alkoxyl group turns into a hydroxyl group in response to hydrolysis easily, and it can take water from a hydroxyl-group comrade further and causes and carries out the polymerization of the dehydration condensation polymerization if alt.alkyl silicate has moisture, such a thing to which dehydration condensation polymerization progressed to some extent can be used for it. What is necessary is in short, for dehydration condensation polymerization to advance with heating and just to have the capacity to make a conductive particle fix on a glass front face in the form of silica gel or a silica eventually. In addition, in order to advance a dehydration condensation polymerization reaction, it is good to make an acid like a hydrochloric acid or a sulfuric acid as a small amount of moisture or a reaction accelerator live together.

[0033] Although an alkyl silicate partial hydrolysis polymerization object can produce alt.alkyl silicate as a start raw material as mentioned above, if the same alkyl silicate partial hydrolysis polymerization object is obtained, the raw material will not necessarily be limited to alt.alkyl silicate. Although ethyl silicate 40 and methyl silicate 51 (Tama chemical industry) can come to hand as a commercial item, such a compound can also be diluted and used for the specified quantity, as it is or after advancing hydrolysis condensation polymerization further. Furthermore, it is also possible to, add the hydrolyzate of alkoxides, such as titanium, a zirconium, and aluminum, for example, if needed.

[0034] As for the addition of the above-mentioned alkyl silicate partial hydrolysis polymerization object, it is desirable for the amount of SiO₂ when solidifying to use with the amount of a conductive particle and below tales doses, or not to contain at all. That is, although it is desirable to be contained 0.1 to 10% of the weight in coating liquid as for a conductive particle, it is desirable to stop by 10 % of the weight of peaks as an alkyl silicate partial hydrolysis polymerization object. The reason is that it will be ruined, or the restoration condition of an electric conduction particle will get worse, and Hayes and resistance will increase if the content of an alkyl silicate partial hydrolysis polymerization object increases more than optimum dose. Although there is an advantage of contributing in improvement in adhesion with a substrate, or membranous spreading nature, addition of an alkyl silicate partial hydrolysis polymerization object does not interfere, even if not contained at all in the coating liquid for [one layer], when an overcoat is given and film surface reinforcement can be secured as two-layer film.

[0035] Baking after applying the coating liquid of this invention to a CRT face panel is performed at the temperature of 150-450 degrees C in atmospheric air. When forming membranes to the CRT glass front in front of vacuum sealing, temperature up is possible to directly under [glass softening temperature], but since there is danger of a burst to membrane formation of the CRT completion ball after sealing when heating temperature is high, it is desirable to carry out below 200 degrees C.

[0036] During baking, condensation-polymerization-izing of silicate and evaporation of a solvent component take place, and the spreading film is contracted, dried and hardened. Since it is 200 degrees C - 250 degrees C that the condensation polymerization reaction of silicate is completed, in baking of 200 degrees C or less, survival of a little unreacted and non-evaporated ink component is not avoided. Therefore, although at least 200 degrees C or less of quite firm film are formed, if a situation allows burning temperature, generally it will be more desirable [the high temperature]. When burning temperature is 250 degrees C or more, the gel condensation reaction and drying of silicate are completed, in order for this to shrink the film further, the pack density of a conductive particle goes up, and a surface-electrical-resistance value falls. Moreover, the contact condition between conductive particles is also improved with evaporation of a solvent component, and the stability and aging of resistance are improved.

[0037] The coating liquid by this invention distributes a conductive particle, and does not form the thin film of the conductive target particle using the decomposition or the chemical reaction of a coating liquid component by the heat at the time of baking. Therefore, the thin film of the uniform thickness by which the property was stabilized can be formed. Moreover, since the temperature which can promote evaporation of a solvent component or a dispersant component or polymerization solidification of an alkyl silicate partial hydrolysate as a burning temperature is sufficient, low dental-curing film which was explained above is possible.

[0038]

[Example] Hereafter, the example of this invention is shown. As the solution (henceforth a "silicate solution") containing the alkyl silicate partial hydrolysis polymerization object used in the following examples, The water-ethanol solution (distilled water 46 section + ethanol 20 section) was dropped having mixed the ethyl silicate 40 made from the Tama chemical industry which is 4 - a pentamer, and agitating the 30 sections and the ethanol 44 section by average degree of polymerization, and the mixed solution of the HCl water-solution 10 section and the ethanol 7 section was dropped further 1% of the weight, and it produced. In the activity, this was suitably diluted with solvents, such as ethanol, and was used with them. In addition, this silicate solution is to show an example and this example does not limit this invention.

[0039] The surface electrical resistance of the formed film was measured using Mitsubishi Petrochemical Co., Ltd. tabulation side ohm-meter MCP-T200. Hayes and permeability -- the Murakami Color Research Laboratory make -- it measured using hazemeter HR-200. In order that a reflection factor might suppress an echo of a sheet glass rear face, it smeared away the rear face black and measured it using the Shimadzu spectrophotometer. Moreover, the JEOL transmission electron microscope estimated the particle size of a conductive particle.

[0040] (Example 1) As the Ag-Pd superfines (7 % of the weight Pd content: chemical analysis (it is below the same)) by Sumitomo Metal Mining Co., Ltd. 15 section with a mean particle diameter of 45nm, the dimethylformamide (DMF) 20 section, and a dispersant After mixing and agitating at a rate of the silane system coupling agent (Toshiba Silicone TSL8802) 5 section and covering the ball mill using a zirconia ball with a diameter of 5mm for 100 hours, ethanol was added, churning mixing was carried out again powerfully, and the distributed coating liquid which the Ag-Pd particle contained 2% of the weight was produced.

[0041] It was dropped from the beaker on the 200x200x3mm soda lime sheet glass which rotates this coating liquid by 150rpm, and the monolayer which calcinated with the burning temperature of 180 degrees C for 30 minutes, and Ag-Pd distributed in atmospheric air after that was produced. Thus, as a property of the formed film, 65% of permeability was obtained surface-electrical-resistance value $4.4 \times 10^3 \text{ohm/**}$, and Hayes 2.3%.

[0042] (Example 2) It was dropped from the beaker on the 200x200x3mm soda lime sheet glass which rotates the same distributed coating liquid as an example 1 by 150rpm, and the aforementioned silicate solution was dropped continuously and the two-layer film which calcinates for 30 minutes with the burning temperature of 180 degrees C in atmospheric air, and consists of an Ag-Pd dispersion layer and an overcoat layer was produced after that. Thus, as a film property of the formed two-layer film, 68% of permeability was obtained surface-electrical-resistance value $8.3 \times 10^2 \text{ohm/**}$, and Hayes 1.6%.

[0043] (Example 3) The titanate system coupling agent (PUREN act KR138 by Ajinomoto Co., Inc. S) was used as a dispersant, and also distributed coating liquid was produced by the same approach as an example 1, and the two-layer film was formed by the same approach as an example 2. The result with the obtained as good film as surface-electrical-resistance value $4.6 \times 10^3 \text{ohm/**}$, Hayes 1.5%, and 72% of permeability was obtained.

[0044] (Example 4) Distributed coating liquid was produced by the same approach as an example 1, this was enough mixed and agitated at the aforementioned silicate solution and a rate of the weight ratio 95:5, spin membrane formation and 180-degree-C baking were performed on the sheet glass substrate by the same approach as examples 1 and 2, and monolayer and the two-layer film were obtained. Thus, as for the acquired film property of monolayer and the two-layer film, 65% of permeability and 68% were obtained surface-electrical-resistance value $6.3 \times 10^4 \text{ohm/**}$, $4.5 \times 10^3 \text{ohm/**}$, Hayes 2.2%, and 1.4%, respectively.

[0045] (Example 5) Baking conditions were made into 30 minutes at 400 degrees C, and also the two-layer film was formed like the example 2, and characterization was carried out. The acquired properties are surface-electrical-resistance $6.2 \times 10^2 \text{ohm/**}$, Hayes 0.9%, and 69% of permeability, and the film with very good conductivity was obtained.

[0046] (Example 6) Ag-Au superfines (3.1-% of the weight Au content) with a mean particle diameter

of 34nm were used as a conductive particle, and also the two-layer film was formed like the example 2, and characterization was carried out. The property that the acquired property is almost equivalent to the case where are surface-electrical-resistance $8.7 \times 10^2 \text{ohm/**}$, Hayes 1.6%, and 73% of permeability, and Ag-Pd is made into a conductive particle was acquired.

[0047] (Example 7) Baking conditions were made into 30 minutes at 350 degrees C, and also the two-layer film was formed like the example 2, using Ag-Cu (4.5-% of the weight Cu content) superfines with a mean particle diameter of 41nm as a conductive particle, and characterization was carried out. The property that the acquired property is almost equivalent to the case where are surface-electrical-resistance $1.7 \times 10^3 \text{ohm/**}$, Hayes 1.4%, and 71% of permeability, and Ag-Pd is made into a conductive particle was acquired.

[0048] (Example 8) Ag-Pd superfines with a same as a conductive particle mean particle diameter [as an example 1] of 45nm and the ITO superfines (ITO-UFP) with a mean particle diameter of 25nm by Sumitomo Metal Mining Co., Ltd. were used at a rate of the weight ratio 3:1, and also the two-layer film was formed like the example 2, and characterization was carried out. Although surface electrical resistance increased a little compared with the case where the acquired properties are surface-electrical-resistance $7.6 \times 10^3 \text{ohm/**}$, Hayes 3.3%, and 77% of permeability, and make Ag-Pd a conductive particle, permeability improved.

[0049] (Example 9) Ag-Pd superfines with a same as a conductive particle mean particle diameter [as an example 1] of 45nm and the ATO superfines with a mean particle diameter of 12nm by Sumitomo Metal Mining Co., Ltd. were used at a rate of the weight ratio 3:1, and also the two-layer film was formed like the example 2, and characterization was carried out. Although surface electrical resistance increased a little compared with the case where the acquired properties are surface-electrical-resistance $4.7 \times 10^4 \text{ohm/**}$, Hayes 3.1%, and 78% of permeability, and make Ag-Pd a conductive particle, permeability improved.

[0050] (Example 10) Ag-Pd superfines with a same as a conductive particle mean particle diameter [as an example 1] of 45nm and the AZO superfines with a mean particle diameter of 46nm by Sumitomo Metal Mining Co., Ltd. were used at a rate of the weight ratio 3:1, and also the two-layer film was formed like the example 2, and characterization was carried out. Although surface electrical resistance increased a little compared with the case where the acquired properties are surface-electrical-resistance $5.3 \times 10^4 \text{ohm/**}$, Hayes 4.1%, and 76% of permeability, and make Ag-Pd a conductive particle, permeability improved.

[0051] (Example 1 of a comparison) Only the ITO superfines (ITO-UFP) with a mean particle diameter of 19nm by Sumitomo Metal Mining Co., Ltd. were used without using the conductive particle which contains the silver of a publication in a claim 1 as a conductive particle. Other actuation formed the two-layer film like the example 2, and carried out characterization. In this case, although $8.6 \times 10^3 \text{ohms}$ of surface electrical resistance and ** were obtained, permeability was not able to be used as the dark film at 96%.

[0052] (Example 2 of a comparison) The Mitsubishi Chemical high conductivity carbon powder of 8nm of mean diameters was used as a conductive particle, and also the film was formed like the example 2, and characterization was carried out. In this case, while permeability became quite dark with 46%, it became very as high [surface electrical resistance] as $3.9 \times 10^8 \text{ohms / **}$.

[0053] It is conductive powder so that clearly from comparison with the above example and the example of a comparison. Although the property desired in a surface-electrical-resistance value, permeability, a reflection factor, etc. cannot be acquired when the processing liquid containing black electric conduction objects, such as transperence noble metals, such as ITO, and carbon, is used By using the coating liquid which distributed the conductive particle containing one sort chosen from the group which consists of palladium, copper, and gold further, or two sorts or more including silver The film which can reduce permeability moderately and has high conductivity required for electric-field shielding can be obtained without raising Hayes.

[0054]

[Effect of the Invention] As explained above, when the burning temperature of 450 degrees C or less and

the low dental-curing film especially of 150 degrees C can also obtain the film which combines an optical property and conductivity in large quantities and cheaply by using the coating liquid of this invention, the effectiveness which applies to the surface treatment of a cathode-ray tube, and can prevent the failure by the leakage electromagnetic wave effectively is done so. CRT of the legible screen where not only an electric-field shielding effect but Hayes is still lower can be supplied, and industrial value is very large.

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CLAIMS

[Claim(s)]

[Claim 1] The above-mentioned coating liquid for transparence electric conduction film formation characterized by particle size being 50nm or less, including one sort which is coating liquid for transparence electric conduction film formation which made the polar solvent distribute a metal particle as a conductive particle, and was chosen from the group which this metal particle becomes from palladium (Pd), copper (Cu), and gold (Au) further including silver (Ag), or two sorts or more.

[Claim 2] It is the above-mentioned coating liquid for transparence electric conduction film formation characterized by being the silver system alloy particle which added one sort chosen from the group to which it is coating liquid for transparence electric conduction film formation which made the polar solvent distribute an alloy particle as a conductive particle, and this alloy particle becomes silver (Ag) from palladium (Pd), copper (Cu), and gold (Au), or two sorts or more, and particle size being 50nm or less.

[Claim 3] Coating liquid for transparence electric conduction film formation according to claim 1 or 2 characterized by including one sort further chosen from tin addition indium oxide, stibiation tin oxide, and the group that consists of an aluminum addition zinc oxide as a conductive particle, or two sorts or more.

[Claim 4] Coating liquid for transparence electric conduction film formation according to claim 1, 2, or 3 characterized by containing an alkyl silicate partial hydrolysis polymerization object.

[Claim 5] claim 1 - claim 4 -- the transparence electric conduction film obtained by either using the coating liquid for transparence electric conduction film formation of a publication.

[Claim 6] claim 1 - claim 4 -- the formation approach of the transparence electric conduction film characterized by calcinating after carrying out the coat of the coating liquid for transparence electric conduction film formation given in either to a base material and carrying out the coat of the solution of an alkyl silicate partial hydrolysis polymerization object on it further.

[Translation done.]